

PiXL Independence:

Mathematics - Student Booklet

KS4 FOUNDATION

Topic 3 – Expressions, Equations and Inequalities

Contents:

- I. Basic Skills Check.
- II. Short Exam Questions.
- III. Further Practice.
- IV. Investigations.
- V. Academic Stretch.

I. Basic Skills Check

Answer the following questions. In order to improve your basic arithmetic you should attempt these without a calculator.

Skills Check 1

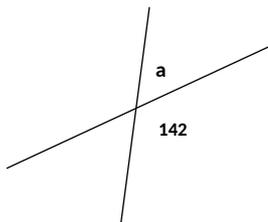
1. What is the product of 20 and 21?
2. The price of a 6 pack of toilet roll is reduced by 4%, the original price was £1.50. What is the new price?
3. Write down three factors of 30.
4. Which of these numbers are square numbers?

1,2,3,4,5,6,7,8,9

5. Simplify $8J + 3k - 7k + 4J$.

6. Solve: $2x + 6 = 12$.

7. Find a.

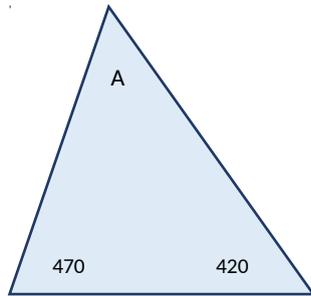


8. In a year group of 120 students $\frac{1}{6}$ th of the class are left handed. How many are left handed?
9. Expand the bracket $7(2a-8)$.
10. In a quadrilateral the angles are 122° , 32° , 120° and A. Find the value of A.

Skills Check 2

1. An electricity bill is £96 plus VAT at 20%. Calculate the VAT charged.
2. A bunch of flowers priced at £15 is reduced by a quarter. What is the new price?
3. Write down all the factors of 50.
4. Round 0.002550 to one significant figure.
5. Simplify $7x + 3y + 2x - 8y$.
6. Solve: $4x - 7 = -3$.

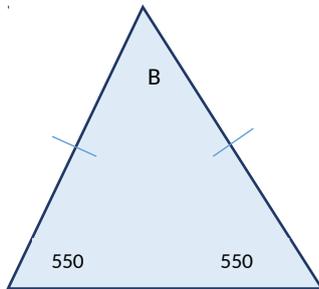
7. Find A.



8. Estimate the answer to 3.45×16.9 .
9. Expand and simplify $3(2a+8) + 3(a-4)$
10. Find the next two terms in the sequence; 20, 10, 5, 2.5,

Skills Check 3

1. A sofa costs £165, delivery costs a further 5%. What is the delivery charge?
2. A train ticket that costs £156 is reduced by a $\frac{1}{3}$. What is the new cost?
3. Find the highest common factor (HCF) of 9 and 33.
4. Round 9.9999 to two significant figures.
5. Expand $2(7x - 1)$.
6. Solve: $3x - 18 = -6$.
7. Find B.



8. In a packet of 30 sweets 4 are red. You take a sweet without looking; what is the probability of choosing a red sweet?
9. Calculate $\frac{1}{6} + \frac{2}{5}$
10. Find the next two terms in the sequence; 9, 13, 17, 21,.....

II. Short Exam Questions

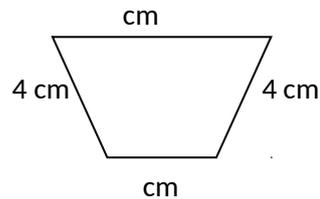
Section 1 - Solving Basic Equations

1. I think of a number, double my number and add 4. I now have 56. What number did I first think of?
2. Solve each of the following equations:
 - a) $x + 7 = 21$
 - b) $y - 13 = 23$
 - c) $6z = 42$
 - d) $\frac{g}{5} = 10$
 - e) $3h + 2 = 20$
 - f) $4f - 3 = 17$
 - g) $\frac{k}{4} + 5 = 8$
3. Use the formula $v = u + at$ to find u when $v = 100, a = 5$ and $t = 10$.
4. Solve $4x + 7 = 43$.
5. Find the value of $3x + 5y$ when $x = -2$ and $y = 4$.
6. Find the value of $3a^2 + 5$ when $a = 4$.
7. Solve the equation $\frac{20}{x} = 4$.
8. Solve the equation $\frac{y}{3} + 5 = 9$.
9. Make p the subject of the formula $t = 5p + 40$.

10. Solve the equation $7x - 3 = 9 + x$.

Section 2 - Forming Equations from Words

1. Find the length of the missing side of the shape below, given the perimeter is 23 cm.



2. a) If p is an odd number, what can you say about $2p$?
b) p and q are odd numbers. Is $p + q$ an odd number, an even number or could it be either?

Write an explanation of how you know.

3. Bag A contains x counters.
Bag B contains 6 more counters than Bag A.
Bag C contains 4 times as many counters as Bag B.
Find the total number of counters in Bags A, B and C. Simplify your answer as far as possible.

4. The perimeter of this rectangle is 32cm. Write down an equation in terms of x and use it to find the dimensions of the rectangle.



5. When Paul asked Simon for his house number, (h) , he replied;

"one subtracted from twice my house number is 47".

Write an equation in terms of h for Simon's house number and then solve the equation.

6. Natalie is 'a' years old. Write down expressions in terms of a for the following people's ages:
- Joyce, who is 10 years older than Natalie.
 - John, who is half Natalie's age.
 - Gavin, who is twice Joyce's age.
 - Steven, who is 4 years older than John.
7. The angles in a triangle are x , $3x$ and $5x$.
Write an equation to find the value of x .
Write down the size of each angle in the triangle.
8. Biscuits are sold in packets. Each packet contains 16 biscuits. Jason buys m packets of biscuits.
- Write down an expression, in terms of m , for the number of biscuits Jason buys.
 - Jason eats six biscuits. Write down an expression, in terms of m , for the number of biscuits left.
9. Rajiv is x years old.
His sister Tanvi is 5 years younger than Rajiv.
- Write down an expression, in terms of x , for Tanvi's age.
The total of Rajiv's age and Tanvi's age is 41 years.
 - Form an equation and solve it to find the value of x .
 - Write down Tanvi's age.
10. The four angles of a quadrilateral are 45° , 105° , $(4x - 15)^\circ$ and $5x^\circ$.
- Form an equation, in terms of x , using this information.
 - Solve your equation and work out the size of the largest angle of the quadrilateral.
11. Jo, Tara & Amy go to a party. They each take CDs to play and have 64 between them. Tara had 9 more than Amy & Amy had 14 more than Jo. How many CDs did Jo bring?

Section 3 - Solving Inequalities

1. For each of the inequalities solve them and then display them on a diagram.

	Solve	Diagram
$2x \geq 10$		
$2x - 4 < 20$		
$10 - x \leq 5$		
$-2 \leq 2x \leq 6$		
$2x + 3 \geq 7$		
$5x + 3 < 23$		

2. Solve the following inequalities:

- a) $x + 7 \leq 21$
- b) $5x - 3 \geq 22$
- c) $4x + 9 < 21$
- d) $6x - 2 > -8$

3. Given n is an integer, list the possible values of n when $3 \leq 3n < 12$.

4. Solve these inequalities and represent the solutions on a number line

- a) $3x < 24$

- b) $2x - 5 > 17$
- c) $2(x + 5) \leq 16$
- d) $7x - 5 \geq 3x + 3$
- e) $3x + 1 < x + 3$

5. Make a list of numbers that satisfy these inequalities.

- a) $2 < y < 8$
- b) $2 < y \leq 8$
- c) $-5 \leq y < 5$
- d) $-1 < y \leq 1$

6. Show the following inequalities on a number line:

a) $x \leq 5$

b) $x > -3$

c) $5 \leq x \leq 11$

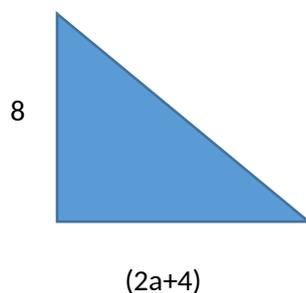
Section 4 - Mixed Exam Style Questions

1. k is an even number.

Jo says that $\frac{1}{2}k + 1$ is always even.

Give an example to show that Jo is wrong.

2. The letters a and b represent prime numbers. Give an example to show that $a + b$ is **not** always an even number.
3. The sides of a rectangle are $2y + 1$, and $y - 3$.
The perimeter is 26cm - find the value of y and the length of each side.
4. Form an equation for the area of the triangle;



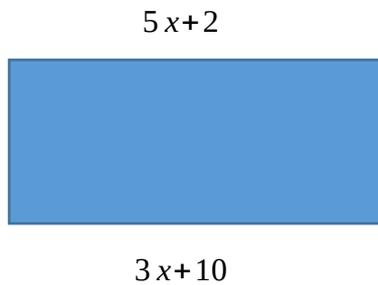
5. A shop sells two sizes of bags of cookies.
The large bag contains 6 cookies and the small bag contains 3 cookies.
- a) How many cookies are there in L large bags?

b) Write an expression for the total number of cookies in L and S small bags.

6. The dimensions of a rectangle are **length** = $2x$ and **width** = $4x - 2$. The perimeter of the rectangle is 32cm. Find the area in cm^2 .

7. The size of the largest angle in a quadrilateral, is 3 times that of the smallest angle. The other two angles are equal and are 30° less than the largest. Work out in degrees the size of all four angles in the quadrilateral. You must show your working.

8. Given that the two lengths are equal, calculate the length of Sides.



9.

A	B
$2p + 4$	$4p - 15$

Expression A is 10 more than twice expression B. Find p .

10. If I double my age, add 4, divide by 5, then take away 2 I get the age at which I first voted (18). How old am I now?

III. Further Practice

1. Try these questions to test your understanding.

<https://www.missbsresources.com/files/ExpandandSimplify.pdf>

2. Pick 3 of the worksheets and answer all the questions.

<http://prehomework.weebly.com/algebra.html>

3. **CONNECT 4.** Print off the sheet and play against another person (you can do this on your own if you don't have a partner).

<https://justmaths.co.uk/Worksheets/Algebra/Algebra%20-%20Solving%20Equations%20%281%29%20-%20Connect%204.pdf>

4. **Read the information carefully.** Which cat has which kitten?

<https://justmaths.co.uk/Worksheets/Extras/Logic%20-%20Here%20Kitty%20Kitty.pdf>

5. **Follow the 'revise, activity, test'.** For each of the three topics the links to the 'revise' part are below. You might want to take screen shots, or make notes as you go to demonstrate how you have got on. Then carry out the activity and the test. Record your score, or try and improve. Check with your teacher which exam board you are using, you might want to change the exam board on the home page.

<https://www.bbc.co.uk/education/guides/z8y9jty/revision>

<https://www.bbc.co.uk/education/guides/z8y9jty/test>

<https://www.bbc.co.uk/education/guides/zpjhy4j/revision>

<https://www.bbc.co.uk/education/guides/zpjhy4j/test>

<https://www.bbc.co.uk/education/guides/z9vkqhv/revision>

<https://www.bbc.co.uk/education/guides/z9vkqhv/test>

- 6. Exam style practice.** For each of the topics you should watch the video, then answer the exam questions and mark your answers. Where have you made mistakes? Is there something you need to do more work on?

Solving equations with unknowns on both sides.

<http://www.mathsgenie.co.uk/solving-equations2.html>

http://www.mathsgenie.co.uk/resources/59_solving.pdf

http://www.mathsgenie.co.uk/resources/59_solvingans.pdf

Forming equations.

<http://www.mathsgenie.co.uk/forming-and-solving-equations.html>

http://www.mathsgenie.co.uk/resources/64_forming-and-solving-equations.pdf

http://www.mathsgenie.co.uk/resources/64_forming-and-solving-equationsans.pdf

- 7. Answer the exam questions.** There are video links on the first page to use if you are still not sure on how to do any of the topics.

<https://corbettmaths.files.wordpress.com/2013/02/inequalities.pdf>

- 8. Answer the questions then mark your work.**

<https://2fv5d843v9w22sxtto1ibxtu-wpengine.netdna-ssl.com/wp-content/uploads/2015/11/Algebra-F-Forming-Solving-Equations-v3.pdf>

<https://2fv5d843v9w22sxtto1ibxtu-wpengine.netdna-ssl.com/wp-content/uploads/2016/01/Algebra-F-Forming-Solving-Equations-v3-SOLUTIONS.pdf>

- 9. Watch the video and answer the questions as you go.**

https://www.youtube.com/watch?v=WOkwdVh_FrY

IV. Investigations

For each of the following you should carry out the investigations then read the notes. You need to keep a detailed summary of what methods/approaches you have tried and what you then changed each time.

1. Pick one of the investigations in the booklet and answer the questions. In order to gain full credit you need to extend your investigation further.

<http://social.ocr.org.uk/files/ocr/Maths%20investigations.pdf>

2. **NRICH activities.** Follow the instructions, can you extend your thinking further? Follow some of the links? Keep notes of what you are doing at each stage. Some of the puzzles have links for you to follow to extend or enrich your understanding. If you do follow the links and carry out any further tasks make sure you keep detailed notes so you can gain extra credit!

<https://nrich.maths.org/5752>

<https://nrich.maths.org/11712>

<https://nrich.maths.org/6260>

<https://nrich.maths.org/12817>

3. **Exploring maths.** Can you follow the clues to match people? Then the extension question asks you to design your own version.

<https://wild.maths.org/whos-who>

4. **Why can you only traverse some of the networks?** Can you investigate further? Are there other websites/resources you can find around this topic?

<https://wild.maths.org/can-you-traverse-it>

V. Academic Reading

Maths in the real world.

For each video or article you should make notes and questions you would like answering to extend your understanding and knowledge of maths in the real world.

1. Follow the **'WATCH, THINK, DIG DEEPER, DISCUSS'**

The fish riddle.

<https://ed.ted.com/lessons/can-you-solve-the-fish-riddle-steve-wyborney>

2. Follow the **'WATCH, THINK, DIG DEEPER, DISCUSS'**

How to squeeze electricity out of crystals.

<https://ed.ted.com/lessons/how-to-squeeze-electricity-out-of-crystals-ashwini-bharathula>

3. Follow the **'WATCH, THINK, DIG DEEPER, DISCUSS'**

<https://ed.ted.com/lessons/a-brief-history-of-numerical-systems-alessandra-king>

4. **Mathematical tricks and calculations. How do you do it?** Can you write detailed instructions on how to carry out these calculations?

<https://www.youtube.com/watch?v=hLdKsKep1og>

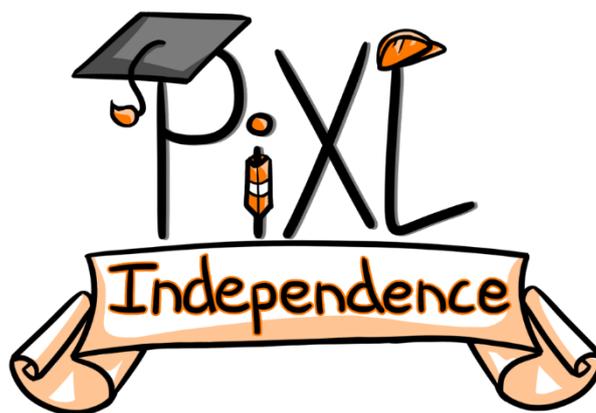
<https://www.youtube.com/watch?v=PYrgjMubh-c>

5. **Why study algebra?** Create a report to argue one side of the argument, is it really worth it?

<http://www.mathscareers.org.uk/article/10-reasons-for-studying-algebra/>

6. Watch the video and use the worksheets to extend your understanding of solving equations.

<https://www.teachmathematics.net/page/4257/balancing-equations>



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